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(56) Documents Cited
GB 2112620 A WO 92/16114 A1 WO 89/08990 A1 WO 82/00084 A1
WPI Abstract Acc. No. 85:023357 & JP 59-220167 (YAMA) WPI Abstract Acc. No. 88:344732 & SU 1397018 (CHERNAUKHA) CAPLUS Abstract No. 124:287877 & Anim. Feed Sci. Technol. (1996) 57(1-2) pages 15-24 CAPLUS Abstract No. 121:132873 & J. Dairy Sci. (1994), 77(6) pages 1630-43 CAPLUS Abstract No. 87:51971 & Dtsch. Tieraerztl. Wochenschr (1977), 84(5) pages 180-5

(58) Field of Search
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(54) Mammalian foodstuff

(57) A mammalian food, food ingredient or a food supplement including hydrolysed feather meal for use in supplementing an adult mammal's feed at a daily rate of at least 0.5gm per 1kg live body weight or at at least 30% of the mammal's daily protein requirement.

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MAMMALIAN FOODSTUFF

Field of the Invention

The present invention relates to a food ingredient or supplement for mammals in particular but not exclusively non-ruminants.

Background of the Invention

It is recognised that sulphur containing organic compounds can have a beneficial effect as a food supplement.

Both naturally and artificially produced such substances have been marketed for their therapeutic effects. Examples of these substances are shark cartilage, chondroitin sulphate, glucosamine and methylsulphonylmethane (MSM) products.

Hydrolysed feather meal is currently fed in small concentrations as a protein additive or ingredient in animal foodstuffs.

The Invention

The invention results from the recognition that hydrolysed feather meal includes sulphur containing organic compounds and that these compounds might provide similar benefits to those provided by the products mentioned above, particularly in cartilage synthesis and maintenance of joint integrity. Work in this field has not suggested that dietary supplementation with high rates of hydrolysed feather meal would benefit joint integrity. It is not generally considered that the necessary nutrients, in good but normal diets, are limiting to joint metabolism.

However tests have indicated that this supplementation has specific benefit in this regard.

The invention resides in the feeding of hydrolysed feather meal at higher rate than previously and specifically for its therapeutic effects.

According to the invention there is provided a food, food ingredient or a food supplement including hydrolysed feather meal for use in supplementing an adult mammal's feed at a daily rate of at least 0.5gm per 1kg live body weight or at at least 30% of the mammal's daily protein requirement.

According to another aspect of the invention there is provided a medical ingredient or supplement of an adult mammal's feed for relieving arthritic and cartilage damage symptoms including hydrolysed feather meal for use in supplementing an animal's feed at a rate of at least 0.5gm per 1kg live body weight or at at least 30% of the mammal's daily protein requirement.

Preferably the food, ingredient or supplement will be fed in combination with carbohydrate foodstuff and additional protein foodstuff, the additional protein foodstuff providing between 0% and 40% of the mammal's daily protein requirement.

In the preferred food the additional protein foodstuff provides between 30% and 40% of the mammal's daily protein requirement. That is to say, the hydrolysed feather meal is fed at a rate of 60 - 70% of protein requirement is expected. However feeding at up to 100% is acceptable.

The food can include of the order of 1 part of molasses for every 4 parts of hydrolysed feather meal. Further, it can contain of the order of 1 part of absorbent material for every 4 parts of hydrolysed feather meal. Preferably the absorbent material is bentonite.

Whilst the invention is intended for use in supplementing an animal's feed, in particular a dog's feed, it is anticipated that in a suitably palatable form, the supplement would be suitable for relieving arthritic symptoms in other animals and indeed humans.

It should be noted that a growing mammal has a higher protein requirement. Higher feather meal feeding rates are required to provide an equivalent % of the daily protein requirement. However feeding for arthritic damage in a juvenile is unlikely to be required.

To help understanding of the invention, certain aspects of the bio-chemistry of mammalian joints, the composition of hydrolysed feather meal, and exemplary supplementation of a dog's feed with hydrolysed feather meal with a view to relief of joint deterioration will now be described.

Certain Aspects of the Biochemistry of Mammalian Joints

Joints between the bones subject to endochondral ossification, e.g. those of the vertebral column and limbs, are the result of a very complex process of development that involves the interaction of several different tissues. The two ends of each bone develop and grow by a mechanism in which the growing cartilage is replaced with bone in the process of endochondral ossification, which means the replacement of cartilage by ossified cartilage and then by true bone.

Hyaline cartilage is composed of two principal structures, giving it flexible characteristics: proteoglycan aggregates of which there are at least five types - the largest being aggrecan and collagen. Collagen is the principal protein in white fibrous connective tissue. The proteoglycan aggregates are complex branched chains of hyaluronic acid, chondroitin sulphate and keratan sulphate together with a link protein and a core protein. Errors, some caused by malnutrition, in the development and growth of cartilage are precursors of poor quality bone. In turn that bone is subject to the effects of dietary failings. Bone is in a continuous state of metabolic flux throughout adult life, so that nutrient intake and hormonal balance continue to influence bone integrity. Failings in dietary adequacy throughout these times increase the risk of bone pain and arthritis.

Chondroitin sulphate is the major sulphated glycosaminoglycan present in the extra-cellular matrix of soft connective tissue (i). Hyaline cartilage contains at least five proteoglycans in its extra-cellular matrix. The largest is aggrecan, containing over 100 chondroitin sulphate and keratan sulphate chains. Chondroitin is a chain of repeating disacchride units, each composed of:

[Glucuronic acid--N-acetylgalactosamine sulphate]n.

This compound contains approximately 7.2% sulphur. The fact that this unit is composed of two different sub-units, one of which is an amino sugar, makes the compound a mucopolysaccharide.

Aggrecan interacts with hyaluronic acid forming large proteoglycan aggregates. Like chondroitin sulphate, hyaluronic acid is another mucopolysaccharide in which the repeating disaccharide units are:

[Glucuronic acid--N-acetylglucosamine]n (ii).

This compound is a polymer, which is believed to be a core molecule. Itself, it is un-sulphated, but the chondroitin sulphate and keratan sulphate chains form branches from the core molecule.

The sulphated glycosaminoglycan chains confer on those chains an ionic charge and they exhibit osmotic properties giving the articulation its ability to resist compressive loads. The loss of this "rubbery" reaction is believed to contribute to the damage associated with arthritis.

The remaining proteoglycans of cartilage are also characterized by their ability to interact with collagen. These proteoglycans, decorin, biglycan and fibromodulin are closely related in protein structure, but differ in glycosaminoglycan composition and function. Decorin and biglycan possess one and two dermatan sulphate chains, respectively, whereas fibromodulin bears several keratan sulphate chains. Decorin and fibromodulin both interact with type II collagen fibrils in the matrix. Biglycan is localized, preferentially, where it may interact with type VI collagen (ii).

The glycosaminoglycan content of cartilage is reduced in osteoarthritis, where it is partially replaced by water, owing to damage incurred by the collagen network. This can no longer restrain the swelling pressure of the glycosaminoglycan (iii). In juvenile rheumatoid arthritis and in adult rheumatoid arthritis the diseased synovial fluid also contains less glycosaminoglycan, therefore are lower concentrations of hyaluronic acid and of chondroitin 6-sulphate (iv). Chondroitin 6-sulphate is the normal adult form of this molecule, whereas in juvenile and arthrosic cartilage a mixture of 4-sulphate and 6-sulphate disaccharide units have been identified. Recent

evidence points to chondroitin sulphate acting as a cross linking agent that stabilises the N-terminal portion of TSG-6 of the hyaluronan binding protein complex (v).

Thus cartilage is a combination of protein chains and chains of hexose units in disaccharide pairs that are richly sulphated. Structural damage to this tissue takes several forms.

It has been recently demonstrated that loss of antioxidant status, and the metabolic stress that results, with extensive free radical formation, are critical to the development of arthritis. It is possible that sulphur containing compounds, such as MSM and methionine, act in the joint as anti-oxidants, breaking chain reactions and so quenching the generation of free-radicals.

It should also be noted that copper is an important component of antioxidant enzymes, some of which have been demonstrated to be important in the control of arthritis.

Composition of Hydrolysed Feather Meal

Feather meal is a product obtained by hydrolizing, drying and grinding poultry feathers. The processing involves pressure cooking, where cooking for 50-60 minutes at 140°-150°C (2.8-3.55kg/cm^2) results in the best product. Feather meal is a good source of natural sulphur compounds.

Table 1. Sulphur composition of feather meal determined by chemical analysis.

	% of feather meal
Total feather meal sulphur	1.980
Total amino acid sulphur	1.127
Total non-amino acid sulphur	0.853

The non-amino acid sources of sulphur include chondroitin sulphate, dermatan sulphate and keratan sulphate, each of about 7¼% sulphur.

Feather meal and cartilage also contain sugar amines. It is these molecules to which the sulphur is attached and the amines are therefore present in dermatan, keratan, chondroitin and also in hyaluronic acid. Keratan contains N-acetylglucosamine-S and galactose; and chondroitin and dermatan contain N-acetylgalactosamine sulphate. Dilute HCl hydrolysis of feather meal shows that it contains 8gm/kg of galactose. The digestion of proteoglycans in the canine intestine is little understood, so that their relevance to cartilage and bone structure maintenance must be speculative. Nevertheless the sulphur content is likely to be well utilised for proteoglycan maintenance in canine cartilage.

Comparison has been made of hydrolysed feather meal with other protein sources.

Fish meal is considered to be one of the highest quality animal proteins and soyabean meal one of the highest quality vegetable proteins for animal feeding. The feather meal, however, contains nearly twice as much methionine plus cystine as is contained in fish meal and it contains 3.3 times as much as is found in typical soyabean meal.

Table 2. Composition of animal and vegetable protein sources for comparison with hydrolysed feather meal, given as % of product (copper as mg/kg).

	Feather Meal %	Fish Meal %	Soyabean Meal %
Dry Matter	90	92	90
Crude Protein	83.5	60	44
Fat	2.5	10	1
Crude Fibre	1.5	-	7
Ash	2.5	19.0	6
Calcium	0.2	5.0	0.25

Phosphorus	0.75	3.0	0.60
Copper, mg/kg	8	6.5	17
Lysine	1.87	4.57	2.73
Methionine	0.43	1.57	0.59
Methionine and Cystine	4.17	2.14	1.26
Threonine	3.86	2.44	1.72
Tryptophan	0.4	0.62	0.59
Gross Energy, MJ/kg	21.1	18.7	17.6
ME poultry, MJ/kg	9.8	12.3	8.9

The chemical analytical procedure for feather meal used a mild acid hydrolysis and so released amino acids that should be largely available to a dog. The ME content of feather meal suggests that it is quite well utilized, as the difference from fish meal could in large part be accounted for by the high fat content of fish meal. Thus the sulphur compounds of the two sources are likely to have equivalent digestibilities.

Exemplary Supplementation of a Dog's Feed with Hydrolysed Feather Meal with a view to Relief of Joint Deterioration

Sulphur, in the form of S-containing amino acids, biotin, heparin, thiamin, insulin, and chondroitin sulphate, makes up about 0.15% of the dog's body weight, i.e. 30gm of a 20kg dog. The diet of this dog should contain daily about 0.75gm of sulphur in organic form. Many adult dogs receive a diet, relatively low in sulphur-amino acid content. The integument (keratin of the skin, hair and claws) of the dog is rich in S-amino acids. It has been known for many years that dietary supplementation with inorganic sulphur is of no benefit in protein synthesis of non-ruminants. The dog must meet its S-amino acid requirements from organic sulphur sources for at least cysteine, cystine and methionine. These amino acids are components of the proteins of cartilage in joints. (Nevertheless, it should be noted that inorganic sources of sulphur can be utilized by a dog in the synthesis of chondroitin sulphate, and heparin).

The feeding of 40gm of feather meal daily would provide 130mg of methionine and 1580mg of cystine, i.e. a total of 1700mg of S-amino acids daily. A 20kg adult

dog requires about 600mg of S-amino acids daily and a growing dog of the same breed, at about 10kg body weight, requires about 2100mg daily.

Feather meal is also a reasonable source of available copper. Excessive quantities of this element would be hazardous, but the amount in 20gm of feather meal should be helpful.

Observational studies indicate that daily supplements of 20-30gm of hydrolysed feather meal given to adult dogs has benefit for maintaining the mobility of joints.

A practical formulation of the hydrolysed feather meal as a dog food ingredient comprises 80% of the meal with 20% of molasses for palatability. To this can be added other supplements, such as vitamins, minerals and other chemical substances. For instance additional vitamin D, copper and calcium is likely to be advantageous. Since the feather meal is liable to cause the dog to produce foul smelling anal wind, containing hydrogen sulphide, I prefer to incorporate an absorbent material such as charcoal or in particular bentonite at a rate of 20% by weight.

Whilst the equivalent of 0.5gm of the feather meal constituent per 1kg live body weight is the minimum recommended rate, I prefer to feed at double this rate. This will provide 60-70% of the dog's daily protein requirement. The balance should be made up from conventional dog food, including meat and biscuit for carbohydrate.

<u>References:</u>

(i) Worral et al., 1994

(ii) Roughley and Lee, 1994

(iii) Venn and Maroudas, 1977

(iv) Spelling et al., 1991

(v) Wisniewski et al. 1994.

CLAIMS:

1. A mammalian food, food ingredient or a food supplement including hydrolysed feather meal for use in supplementing an adult mammal's feed at a daily rate of at least 0.5gm per 1kg live body weight or at at least 30% of the mammal's daily protein requirement.

2. A medical ingredient or supplement of an adult mammal's feed hydrolysed feather meal for relieving arthritic and cartilage damage symptoms including for use in supplementing an animal's feed at a rate of at least 0.5gm per 1kg live body weight or at at least 30% of the mammal's daily protein requirement.

3. A food, ingredient or supplement as claimed in claim 1 or claim 2, in combination with carbohydrate foodstuff and additional protein foodstuff, the additional protein foodstuff providing between 0% and 40% of the mammal's daily protein requirement.

4. A food, ingredient or supplement as claimed in claim 3, wherein the additional protein foodstuff provides between 30% and 40% of the mammal's daily protein requirement.

5. A food, ingredient or supplement as claimed in any preceding claim, including of the order of 1 part of molasses for every 4 parts of hydrolysed feather meal.

6. A food, ingredient or supplement as claimed in any preceding claim, including of the order of 1 part of absorbent material for every 4 parts of hydrolysed feather meal.

7. A food, ingredient or supplement as claimed in claim 6, wherein the absorbent material is bentonite.

The Patent Office

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Application No: GB 9716036.0
Claims searched: 1-7

Examiner: Dr J. P. Bellia
Date of search: 22 October 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): A2B (BMA2) A5B (BE)

Int Cl (Ed.6): A61K 35/12, 35/36

Other: ONLINE: WPI, CAS, STN INDEX (PHARMACOLOGY)

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2112620 A	(FRITZ) page 1 line 108-115 & Example 1	1,3 & 5
X	WO 92/16114 A1	(KEMP) page 5 line 11-33 & page 9 line 1-19	1,3 & 4-7
X	WO 89/08990 A1	(NORTH CAROLINA UNIV.) page 5 line 30 - page 6 line 10	1,3 & 4
X	WO 82/00084 A1	(STORD BARTZ) Page 14 line 9-19	1
X	WPI Abstract Acc. No. 85:023357 & JP 59-220167 (YAMA) see abstract		1
X	WPI Abstract Acc. No. 88:344732 & SU 1397018 (CHERNAUKHA *et al*) see abstract		1
X	CAPLUS Abstract No. 124:287877 & Anim. Feed Sci. Technol. (1996), 57(1-2) (CHIBA *et al*) pages 15-24, see abstract		1
X	CAPLUS Abstract Acc. No. 1995:885893 & J. Anim. Sci. (1995), 73(10) (PATE *et al*) pages 2865-72, see abstract		1
X	CAPLUS Abstract No. 121:132873 & J. Dairy Sci. (1994), 77(6) (PALMQUIST *et al*) pages 1630-43, see abstract		1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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A	CAPLUS Abstract No. 87:51971 & Dtsch. Tieraerztl. Wochenschr. (1977), 84(5) (DROCHNER) pages 180-5, see abstract	-

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.